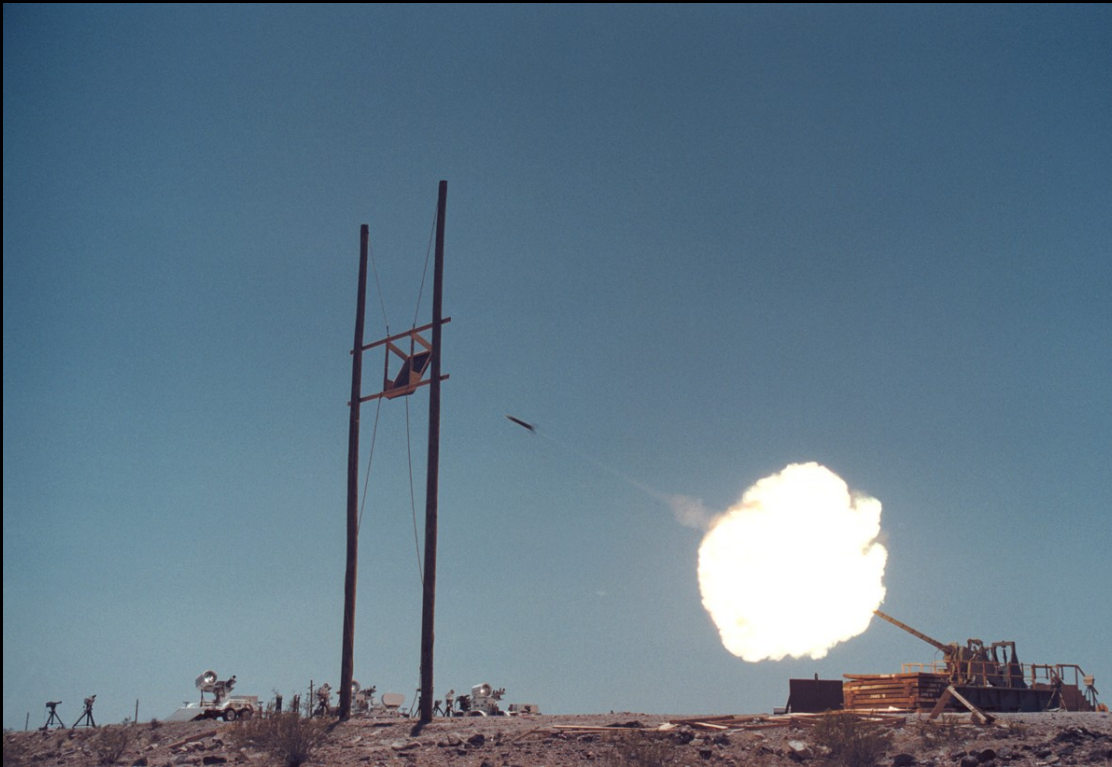




Pressure Measurement in a 62 Caliber Cannon

US Navy 5"/62 Gun



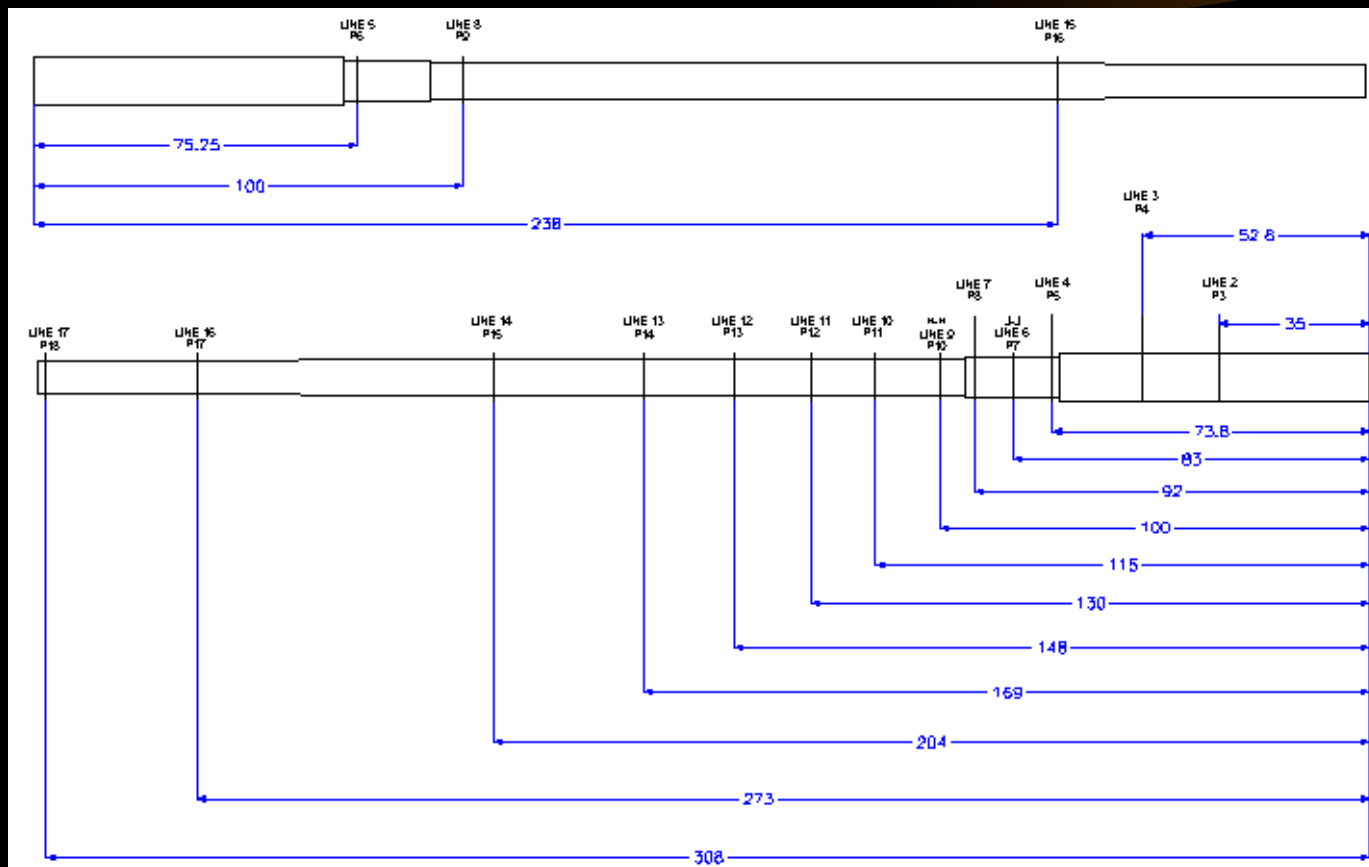
The retirement of the Iowa Class of Battleships has resulted in a shortfall of shore bombardment capability. This function is to be filled by longer range smaller caliber cannon based on the 5" Mk 45 and firing

Instrumentation Challenges

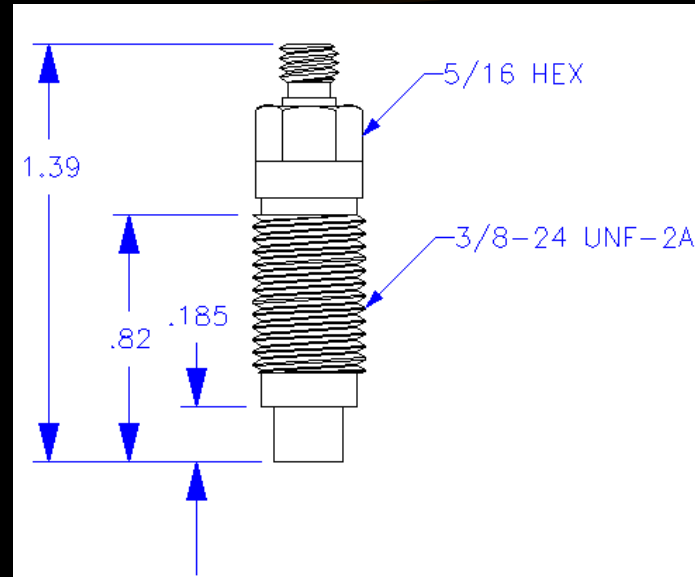


- Provide reliable data
- Sensors must survive
- Sensor Maintenance must be low

16 Channels of Data – 14 Tube Mounted, 2 Breech Mounted

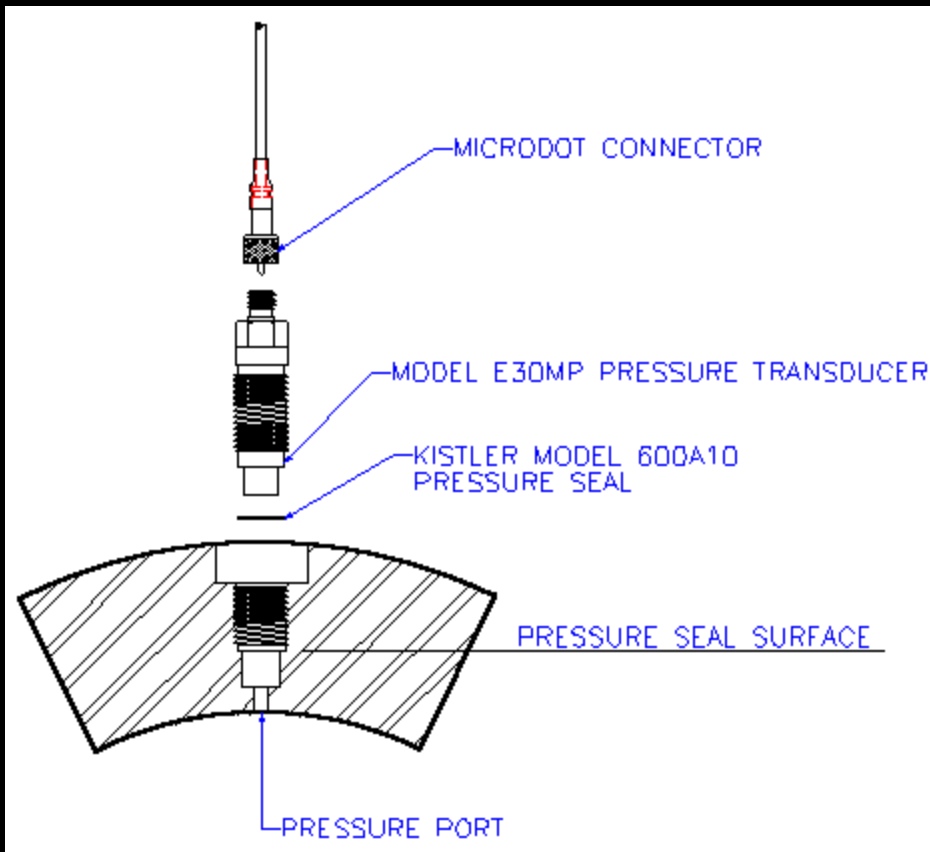


Ballistic Pressure Transducers



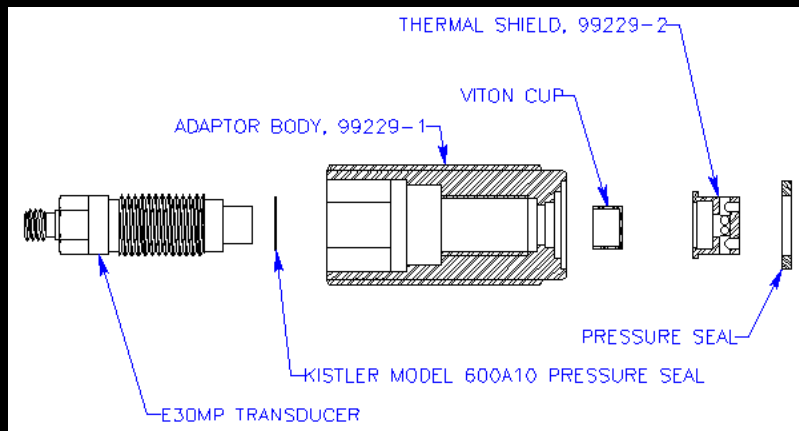
On the left, the Kistler Model 607 is a shoulder sealing Quartz based piezo-electric transducer. Problems with this gage led to the use of the similar E30MP. On the right, the US Army Model E30MP is a shoulder sealing Tourmaline piezo-electric transducer employing the same sensing element as the proven Model E30MA, but designed for use in the same envelope as the Kistler Model 607.

Typical Installation

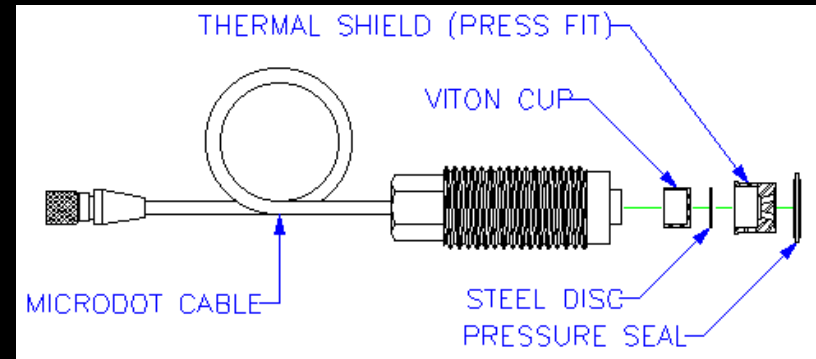


Thermal Protection for the E30MP had consisted of injections of Pennzoil 705 Grease before each round fired. Time between rounds was on the order of one hour for this action alone.

Thermal Protection Adaptor



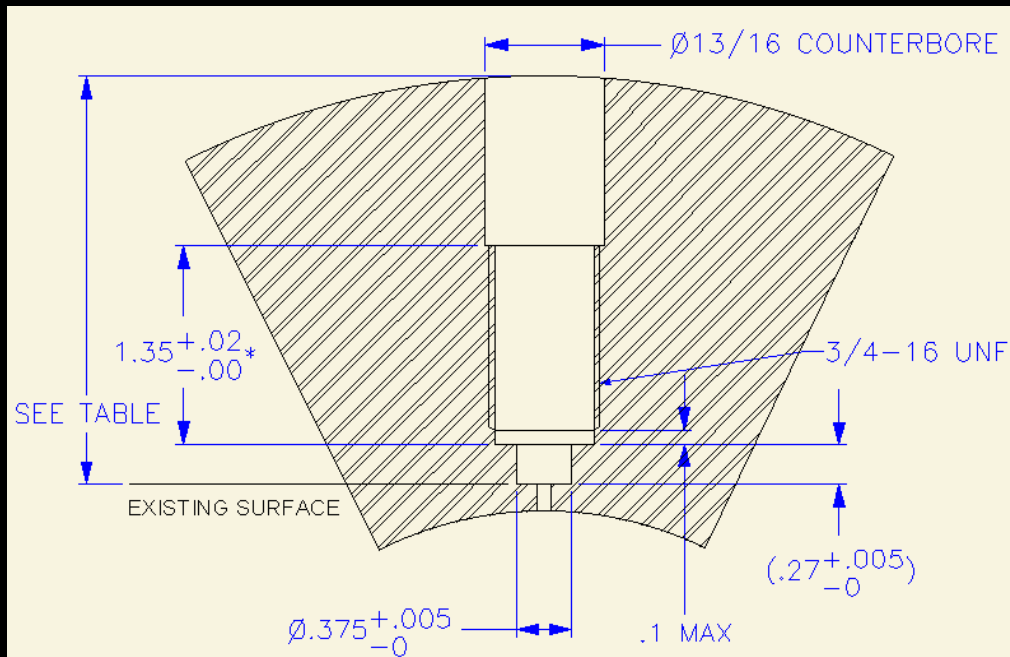
E30MP in Thermal
Adaptor



150KFM Transducer

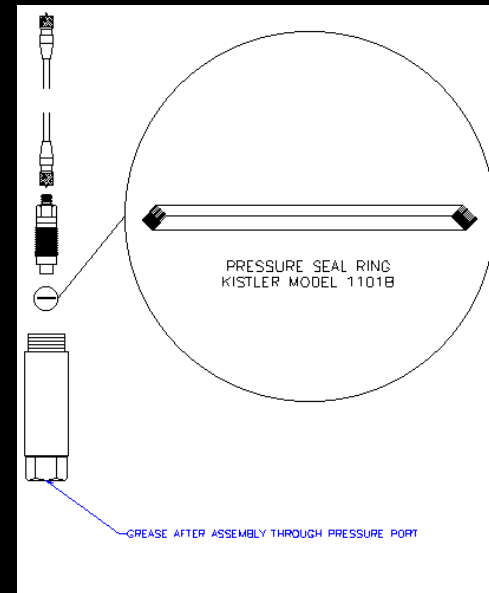
Thermal protection derived from transducers developed for the US Army Advanced Field Artillery System.

Cannon Tube Modification



Twelve pressure ports were modified to a new configuration to accommodate the Thermal Protection Adaptors.

Breech Instrumentation



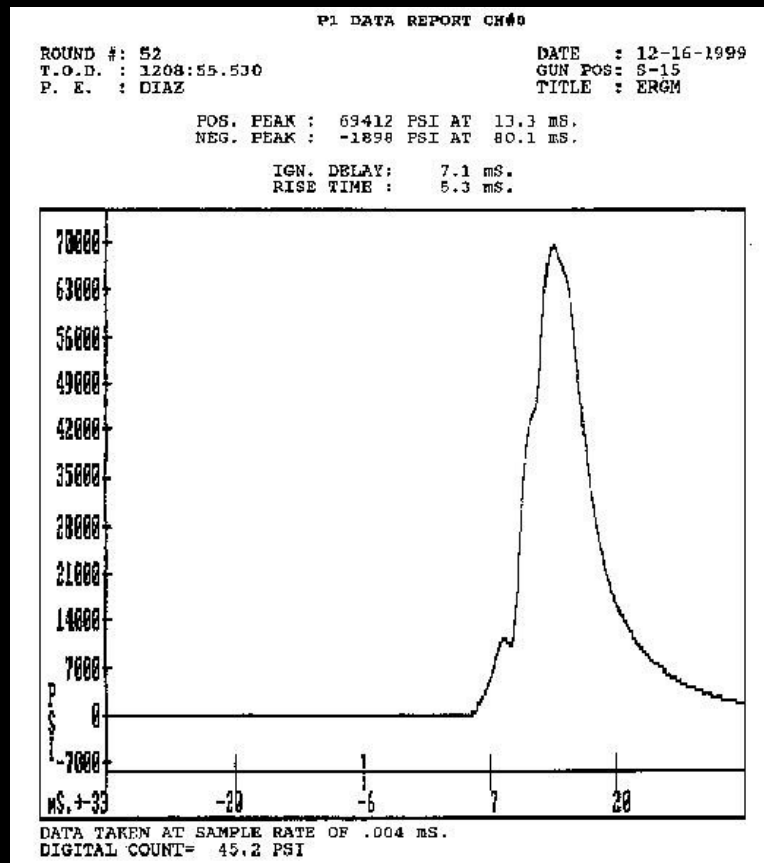
Cartridge Case mounting of E30MA and Mounting Adaptor. Transducers were assembled to Adaptors, greased and then installed in the Cartridge Case

Post Test Analysis



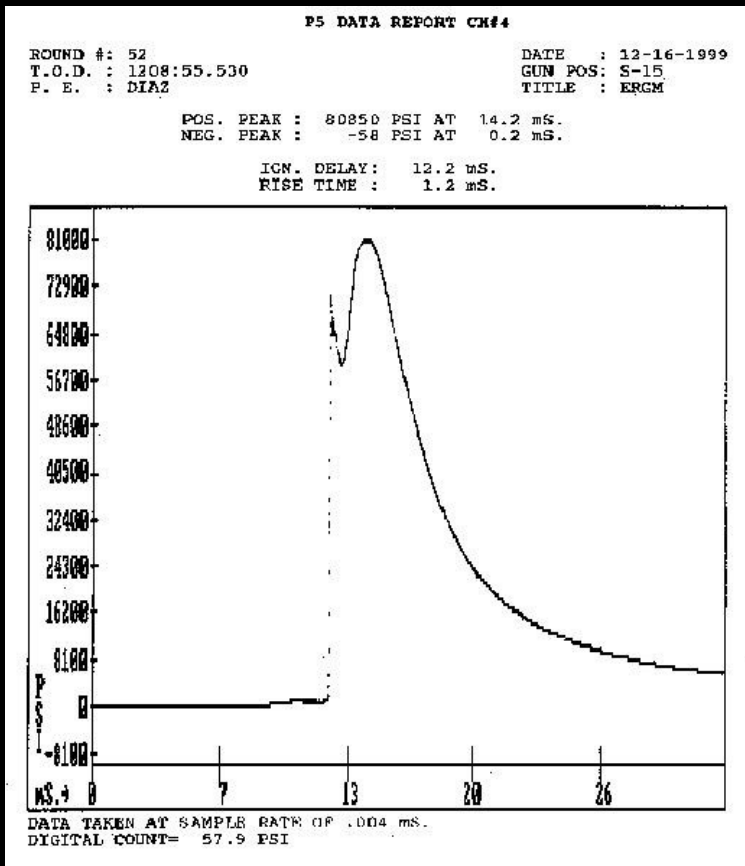
Thermal Protection Adaptors provided an added benefit of preventing residue impingement on the sensing element.

Post Test Analysis



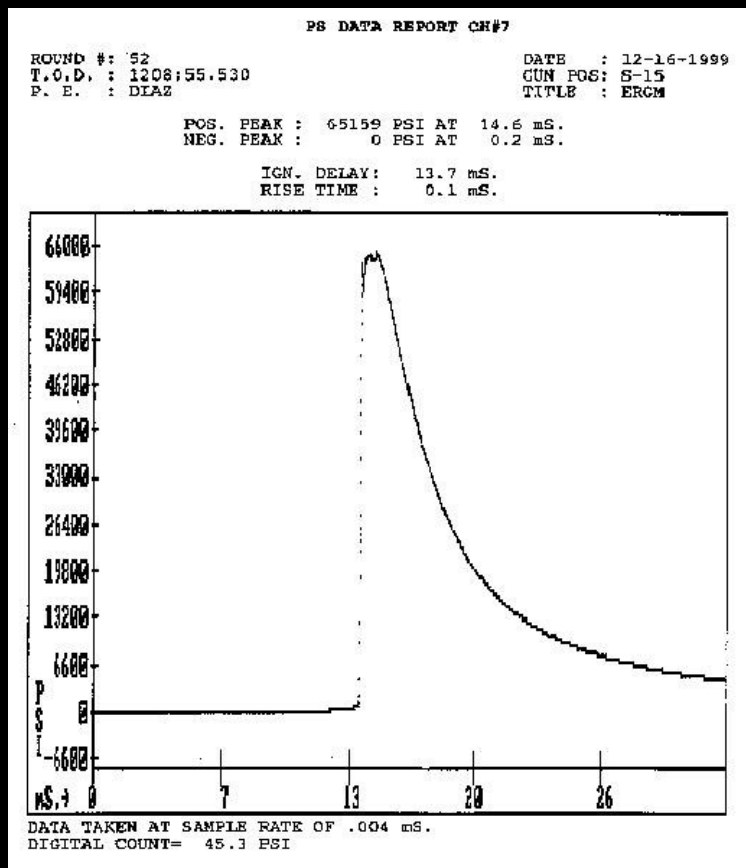
Pressure Trace
from Breech
Mounted
E30MA

Post Test Analysis



Pressure Trace
from 73.5 inch
RFT position.
Spike is most
probably from
the sudden
passage of the
rotating band.

Post Test Analysis



Pressure Trace
from 93 inch
RFT location.
Oscillations at
the top of the
curve can lead
to false peak
pressure
readings.

Conclusions:



- US Army Model E30MP Transducers continued to provide usable data to the test sponsor.
- Creation of the Thermal Protection Adaptor afforded the use of previously manufactured sensors with no reduction in sensitivity and an improved level of sensor survivability and ease of use.
- Testing of other ordnance systems can benefit from these lessons learned.